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Determination of Milk Production Characteristics and Milk Losses Related to Somatic Cell Count in Jersey Cows Raised in the Black Sea Region of Turkey

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Abstract: This study was conducted to determine the Milk Production Characteristics (MPC) and to estimate milk losses related to Somatic Cell Count (SCC) in Jersey cows raised in Turkey conditions. In total, 330 cows were examined between January and December 2005. The SCC analysis were performed by direct microscopy and MPC values were calculated by Holland method. Effect of parity on MPC parameters were significant ($p<0.001$). While Lactation Length (LL), daily Milk Yield (dMY), Lactation Milk Yield (LMY) and 305 daily Milk Yield (305 dMY) were estimated as 274.8±4.2 d, 11.6±0.1, 3219.7±63.9 and 3457.3±46.4 kg, respectively, MPC levels tended to rise with later parities. Milk losses were lowest in first parity cows and losses (%) in dMY, LMY and 305 dMY were 14.96, 14.83 and 13.95, respectively. In conclusion, husbandrial practices related to herd management should routinely be checked by dairy farmers to obtain higher quality milk and to minimize milk production losses.

Key words: Milk yield, milk loss, somatic cell count, Jersey

INTRODUCTION

Today, obtaining high quality and quantity milk from dairy enterprises is the main target of dairy industry in many countries. In this context, taking required measures in the farms should be considered by dairy farmers. Such that, managerial and financial abilities of dairy owner are key points for profitability and survivability of a dairy farm (Chassagne *et al*., 2005). That's why, strategies to produce higher milk are important in decreasing expenses and upgrading the quality of production. A number of study (Firk *et al*., 2002; Bennedsgaard *et al*., 2003; Carlen *et al*., 2004; Green *et al*., 2006) have been carried out to determine the relationship between quality and milk production parameters especially in Holstein cows. Of quality parameters, Somatic Cell Count (SCC) is the most widely used and most feasible measures of monitoring udder health and in many countries, SCC values are combined with milk records (Pösö and Mäntysaari, 1996). Somatic cells are simply animal body cells present at low levels in normal milk and above certain threshold values (the legal limit in EU is 400×10^3 by EU Directive 92/46/EEC) delivery is not accepted (Leth *et al*., 2004). Although, levels of SCC in milk are influenced by parity, age, stage of lactation, season, stress, milking interval and breed (Harmon, 1994) the main factor affecting SCC is mammary gland infection (Koc, 2008). According to some studies (Yalcin *et al*., 2000; Juozaitiené and

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Zakas, 2002), milk production levels of cows are adversely affected by elevated SCC of milk (or subclinical mastitis). Miller *et al.* (2004) referred this negative relationship between SCC and milk yield to be milk loss. Besides, some authors apparently pointed out that cows with mastitis do not regain their premastitis milk yields during the remainder of lactation. Moreover, high SCC in milk affects the price of milk in many payment systems that are based on milk quality (Rupp and Boichard, 1999). In spite of some studies have been conducted about Milk Production Characteristics (MPC) of various dairy breeds raised in Turkey (Sekerden, 1999; Ulutas *et al*., 2004; Cilek and Tekin, 2005), there is lack of report on milk yield of Jersey cows, the main culture dairy breed in the Black Sea region of Turkey and no investigation has been carried out to determine milk production losses related to SCC levels of milk. Therefore, the aim of the present study were to investigate the milk production traits of Jersey cows in Turkey conditions and to estimate milk yield losses related to SCC of milk.

MATERIALS AND METHODS

Cows Selecting and Milk Sampling

A total of 330 Jersey cows raised at Karakoy State Farm of Samsun Province, in the Black Sea region of Turkey, were used. All cows were free from clinical mastitis, lactating, primi-and multiparous and milked twice per day. During January to December 2005, the farm was visited monthly and milk samples from evening milkings were collected from the cows. Before sampling, teats were cleaned with tepid water and first streams of foremilk were discarded, thereafter, 10 mL milk was taken from each teat into sterile tubes by hand-stripping. No preservative added milk samples were stored at 4°C in an ice-cooled box until SCC analysis.

SCC Analysis

After collecting raw milk samples, SCC tests were applied within 24 h by direct microscopy. Used strain was composed of 0.6 g of certified methylene blue chloride to 52 mL of 95% ethyl alcohol, 44 mL of tetrachlorethane and 4 mL glacial acetic acid. Total number of fields counted per slide was 40 and the Working Factor (WF) was 13255.

Calculating MPC and Milk Losses

Lactation Length (LL), daily Milk Yield (dMY), Lactation Milk Yield (LMY) and 305 daily Milk Yield (305 dMY) were used as the MPC parameters. To determine milk yields and lactation lengths, Holland method was performed (Kaya *et al*., 2002). In this method, when the LL values were exceeded 305 d, only Milk Yield test results belong to 305 day were used. In evaluating losses of milk production levels (%), Table 1, which was suggested by Kirk (1984), was used.

Table 1: Milk production losses due to SCC

SCC range (x1000)	Yield loss (kg day^{-1})*
0-17	0.00
18-34	0.00
35-70	0.00
71-140	0.68
141-282	1.36
283-565	2.04
566-1130	2.72
1131-2262	3.40
2263-4525	4.08

*Approximate conversion from pounds. The loss by heifers in first parity is one-half this amount

Statistical Analysis

The data were examined by general linear model procedure of SPSS statistical package (SPSS, 1999) and means were compared by Duncan's multiple range test. The model was as follows:

$$y_{ij} = \mu + a_i + e_{ij}$$

where, y_{ij} is observation value for MPC, μ is population mean, a_i is effect of parity (i = 1 to 5) and e is random residual effect.

RESULTS AND DISCUSSION

In this investigation, MPC values by parity are shown in Table 2. As seen that, especially obtained LL values clearly indicate that LL tended to increase with advancing parity. Average LL of Jersey cows was estimated to be 274.8±4.2 d. Also, in the present investigation, multiparous cows had higher dMY than primiparous cows. Similar to LL, the lowest value in LMY (2427.0±127.1 kg) and 305 dMY (2884.2±97.1 kg) were calculated for primiparous cows and the highest values (3664.8±124.3 and 3747.9±80.8 kg, respectively) were obtained for the cows with latest parity. Besides, as seen from Table 2, except for LL, all MPC parameters of 1st parity group were statistically different from others ($p<0.001$).

The SCC means and MPC losses by parity are given in Table 3. As seen that, milk losses (%) were minimal in first parity cows for all traits. However, no significant differences existed among the parity groups. Also, estimated losses caused by SCC were nearby to 14%. Also, as seen from Table 3, SCC values both parity subgroups and overall mean were reasonable with EU directives ($<400\times10^3$ SCC mL^{-1}).

The overall mean LL (274.8±4.2 d) estimated in this study was lower than finding calculated in an earlier study in this region (Sekerden and Ozkutuk, 1990), but 305 dMY was relatively higher. And also, overall LL mean was lower than some study results by Teodoro and Madalena (2003), Diack *et al*. (2005), Mondal *et al*. (2005) those had been conducted on pure or crossbred Jersey cows. As seen that, MPC values were lowest in first parity cows and highest in cows with 5th parity. This result was contradictive with study

Table 2: Milk production characteristics (Mean±SE) by parity

Parity	n	LL (d)	dMY (kg)	LMY (kg)	305 dMY (kg)
1	59	239.2±11.5^{A}	10.0±0.4^{A}	2427.9±127.1^{A}	2884.2±97.1^{A}
2	66	267.7± 8.7^{AB}	11.6±0.3^{B}	3192.9±149.9^{B}	3492.2±114.2^{B}
3	70	275.8±7.7^{AB}	11.5±0.3^{B}	3188.7±127.3^{B}	3437.6±100.1^{B}
4	50	288.2±9.2^{B}	11.9±0.3^{B}	3475.9±137.2^{B}	3620.9±95.7^{B}
5	85	296.2±8.4^{B}	12.4±0.2^{B}	3664.8±124.3^{B}	3747.9±80.8^{B}
Overall	335	274.8±4.2	11.6±0.1	3219.7±63.9	3457.3±46.4

Within the columns the numbers with different superscripts differ significantly ($p<0.001$)

Table 3: The SCC means by parity and milk production losses related to SCC

		Losses in MPC (%)		
Parity	SCC (cells mL^{-1})	dMY	LMY	305 dMY
1	328686	9.26	9.13	7.80
2	310138	14.96	14.61	13.52
3	327377	15.07	15.00	14.06
4	383204	14.63	14.47	13.97
5	365701	11.13	14.15	13.88
Overall	343619	14.96	14.83	13.95

results reported by Koc (2006) and Erdem *et al*. (2007). Bajwa *et al*. (2004) emphasized that season of calving, year or age at calving were effective on LL. As parallel with this case, relatively low LL in the study may be explained by the effects of non-genetic factors. However, estimated dMY value was relatively lower than the study result of Muller and Botha (1998). This fact may be explained by the climatic or managemental differences of the regions. Obtained findings for MPC can be assumed as expected results. Due to advancing feed consumption, body structure and physiological function or more damage occurrence in cells of mammary gland of cows with later parities might be effective on these findings. Thus, the results in this investigation were in agreement with study results of Uzmay *et al*. (2003) but not paralleled with the study of Ozkan and Gunes (2007), Koc (2006) and Erdem *et al*. (2007). Furthermore, Busato *et al*. (2000) pointed out the relationship between management levels and milk production amount of farms, also, Bayram *et al*. (2008) indicate to effects of farming systems on milk production level.

While SCC values both parity subgroups and overall mean were lower than EU directives, SCC thresholds of this study warned to potential risk for prevalence of new subclinical mastitis cases in the herd. In that, in a study of Juozaitienė and Zakas (2002), milk yield was reached to minimal grade due to elevated SCC. Moreover, milk with high SCC has its coagulation properties compromised and the efficiency of cheese production reduced (Miller *et al*., 2004).

Besides, it can be clearly understood from Table 3 that milk losses (%) were lowest in primiparous cows. Hagnestam *et al*. (2007) emphasized that management, breed, yield level and analytical method used were effective on milk losses. Present finding may be explained by the lower milk production level and LL of first parity heifers. Indeed, Table 1, in which yield losses (kg day^{-1}) in first parity cows were half of the other ones, supports this opinion. Similar to this result, Hortet and Seegers (1998) and Koldeweij *et al*. (1999) reported that milk yield losses raised with later parities. In contrary, Miller *et al.* (2004) emphasized that milk losses due to SCC reduced with advanced parities. Moreover, while all MPC losses obtained in this study were in harmonious with each other, these losses were also nearby to findings of Erdem and Atasever (2009), who estimated from 17 previously study results on milk losses caused by SCC of Holsteins raised in Turkey. Miller *et al.* (2004) reported a decrease in 305 dMY of 54.6 and 61.4 kg per Somatic Cell Score (SCS) unit increase on the first test-day for the first and second parities, respectively. Hagnestam *et al*. (2007) reported that mastitic multiparous cows had reduced 305 d yields of 0 to 11% milk. Precisely, a loss in milk production, for any reason, reflects a suboptimal production and is therefore, always of great importance for an efficient dairy production (Koldeweij *et al*., 1999). Such that, Ott and Novak (2001) estimated that herds with low SCC annually generated $103.90/cow more in herd productivity than herds with medium SCC and $292.39/cow more than herds with high SCC. To minimize this handicap, Przysucha and Grodzki (2004) indicated that better care of production hygiene, proper milking technique, feeding and tending of animals observed in the farms has a reflection in better hygienic quality (lower SCC) of milk.

CONCLUSIONS

In the current study, MPC and SCC values of Jersey cows were found in moderate levels. However, quality and quantity of milk production could be reached to better grades. Milk losses estimated in the present investigation clearly shown that some husbandrial practices related to farm management are needed to revise for preventing financial losses concurrently. Also, further studies are needed to reveal the associations between SCC level of milk and milk losses in different dairy breeds.

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